
Project Phase 2

Board Test Software and Board Verification

(Due by the end of week 13)

Tasks

The project deliverables are:

1. Demonstration of software control of the specified hardware blocks as listed on the following pages. Code to be written in C and demonstrated on the STM32 Nucleo board.
2. Demonstration of the above with the Nucleo board installed on and controlling the student's board. (i.e. verification of the hardware design and implementation)
3. Integration of the above software modules into a single application with an RS232 text-based interface to exercise the hardware test functions developed above

Schedule

To receive full credit, the items on the rubric need to be completed and demonstrated before the end of the semester (End of Week 13). Demonstrations will occur during the Friday afternoon debriefing sessions or during the week if time permits. It is your responsibility to develop your own schedule and show progress against this schedule on a weekly basis.

The effort required to complete this project is considerable and it will require disciplined effort on your part to complete it successfully.

Marks

Items on this rubric are worth 50% of the final project course mark and are for individual work using software written individually running on the student's own board or faculty-approved alternative.

In the following table, all items are equally weighted.

The breakdown of the 50% grade is as follows:

- **30%** - Required S/W modules running on Nucleo board (possibly demonstrated with scope, logic analyser, breadboard, etc. if student's board is not functional)
- **10%** - Debugged and functional H/W modules on student's board
- **10%** - Integrated test framework software with all module test code (as above) integrated into a single executable image with a text-based interface to exercise all H/W test functions from a PC using RS232 communications

Student's Name: _____

	Not shown	Basic function (receives 6 marks max)	Library-Quality Function(s) (receives 10 marks max)	Student H/W Working?	Comments	S/W Mark /10
Stepper Motor & Limit Switches		Move motor with full/half step waveforms at fixed speed (show on logic analyzer). Demonstrate that S/W can read the state of both limit switches.	Functions to init device, move motor with parameters for speed, direction, full/half step, move by a fixed number of steps or to a specified position.. Stepping happens in ISR. Function to get motor's current position and state. Homing function to determine the range of motion of the stepper motor using the limit switches and centre the camera			
RC Servo		Generate waveforms to move RC servo to variable positions	Function to init device, set position of servo in degrees. Detect out-of-range parameters and return error code.			
DC Motor (Open-Loop motion)		Moves a motor in both directions - motor can move at different speeds by driving different PWM values	Open-loop Motor() function taking parameters of motor number, drive duty cycle (0 – 100%), and motor direction (CW/CCW).			
DC Motor Encoder (Motor speed measurement) (may demonstrate with signal generator)		Measure motor speed in one direction by timing the edge-to-edge signal from an encoder wheel using the timer input capture function	Adding to the basic techniques, - can correctly handle a wide range of motor speeds in both directions - can measure both motor speeds simultaneously - measurement uses interrupts to set a static global variable with the most recent value. Access functions to read the static variable value.			
RS-232 Serial Communications		Polled Rx, Polled Tx, Send/Receive individual characters to PC	Interrupt Rx, Polled Tx, functions to init device, send/receive strings (like puts/gets), Send formatted strings UARTprintf()			
LCD		Put characters on display	Functions to init device, clear display, LCDprintf() function to do a formatted print to the display			
Extra H/W Features (Bonus)						

	Not shown	Required function	Mark /10
Text-based Interface on PC Terminal Emulator		Text menu displayed on terminal emulator window. Function selected by pressing number or letter. Any necessary parameters entered as text string followed by enter.	
Stepper Motor & Limit Switches		Home stepper motor Read limit switch state Send stepper to specified position Set/get step type (full/half) Get stepper motor position	
RC Servo		Position servo at specified degree within valid range	
DC Motor (Open-Loop motion)		Turn on either motor in specified direction with specified duty cycle. Turn off motor	
DC Motor Encoder (Motor speed measurement)		Display current speed of motor as read by encoder (may demonstrate with signal generator instead of encoder)	
LCD		Send text string to show on LCD module	
Extra H/W Features (Bonus)			

HW Modules (Scale to 10)	SW Modules (Scale to 30)	Integrated Test (Scale to 10)
6	60	60